INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT

DRY UNIT WEIGHT OF FLOWABLE BACKFILL ITM No. 218-08T

1.0 SCOPE.

1.1 This test method covers the procedures for sampling and measuring the dry unit weight of flowable backfill.

1.2 The values stated in either acceptable English or SI metric units are to be regarded separately as standard, as appropriate for a specification with which this ITM is used. Within the text, SI metric units are shown in parenthesis. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other, without combining values in any way.

1.3 This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 ASTM Standards.

D 4832 Preparation and Testing of Controlled Low Strength Material Test Cylinders

D 5971 Sampling Freshly Mixed Controlled Low-Strength Material

2.2 AASHTO Standards.

M 231 Weighing Devices Used in the Testing of Materials

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101.

4.0 SIGNIFICANCE AND USE. This ITM is used to sample, mold, cure, transport, prepare, and measure the dry unit weight of flowable backfill.

5.0 APPARATUS.

5.1 Cylinder molds, conforming to the requirements of ASTM D 4832 except that the molds shall be 6 in. (152 mm) by 12 in. (304 mm) plastic with a 0.125 in. (3 mm) diameter hole drilled in the center of the bottom of the mold. Tape shall be used to cover the hole drilled in the bottom of the cylinder.

5.2 Compressed air source, with a load of 30 ± 10 psi (210 ± 70 kPa) and a nozzle opening of 0.5 in. ± 0.125 in. (13 mm ± 3mm)

5.3 Oven**,** with at least 1.75 ft^3 (.05 m^3) capacity and capable of maintaining a temperature at 221 ± 9°F (105 ± 5°C)

5.4 Balance, Class G2, conforming to the requirements of AASHTO M 231

5.5 Calipers, readable to 0.001 in. (0.0254 mm)

6.0 SAMPLING. Sampling of the flowable backfill shall be in accordance with ASTM D 5971.

7.0 PREPARATION OF TEST SPECIMEN.

7.1 One specimen is required to determine the dry unit weight. Measurements of the specimen diameter, height, and weight to determine the dry unit weight are from this specimen.

7.2 Molding, initial curing, and transporting of the test specimen shall be conducted in accordance with ASTM D 4832, except that the mold lid shall not be used. After initial curing, the test specimen shall be placed in a moist closet or moist room or stored in an enclosed curing tank above water level with the cylinder lid in place. The specimen shall be kept in the mold in the moist storage for the remainder of the curing period.

7.3 Removing the Specimen Mold. The specimen mold shall be removed carefully so as not to damage the sample prior to testing. (Two operators may be required to safely remove the specimen from the mold.)

7.3.1 Remove the tape from the bottom of the sample mold

7.3.2 Place the nozzle of the compressed air source at the bottom of the specimen at the location of the drilled hole

7.3.3 Use the compressed air to slowly force the specimen out of the cylinder mold

7.4 Cure the specimen using the same procedure as the compressive strength specimen, except oven dry the specimen at the age of 28 days in an oven

7.5 Create a plane surface for testing by sawing the ends of the specimen, if necessary. The minimum length to diameter ratio shall be 1:1. (The specimen shall not be capped.)

7.6 Place the sample in the oven at 221 ± 9°F (105 ± 5°C) for 24 h

7.7 Cool the sample to room temperature. Weigh the sample until a constant weight (mass) is achieved. The weight (mass) is considered constant if the weight variation does not exceed 1 %.

7.8 Record the weight (W) of the sample in pounds

7.9 Measure the diameter (D) of the sample in three different locations, D_1, D_2, and D_3.

7.10 Measure the height (H) of the sample in three different locations, H_1, H_2, and H_3.

8.0 CALCULATIONS.

8.1 Calculate the average diameter of the specimen as follows:

$$\text{Average Diameter, ft} = \frac{D_1 + D_2 + D_3}{3}$$

where:

D_1 = diameter at the first sample location, ft
D_2 = diameter at the second location, ft
D_3 = diameter at the third location, ft

8.2 Calculate the average height of the specimen as follows:

$$\text{Average Height, ft} = \frac{H_1 + H_2 + H_3}{3}$$

where:

H_1 = height at the first location, ft
H_2 = height at the second location, ft
H_3 = height at the third location, ft

8.3 Calculate the volume of the sample as follows:

$$\text{Volume, ft}^3 = 3.1416 \text{ x } \left(\frac{D}{2}\right)^2 \text{ x H}$$

where:

D = average diameter, ft
H = average height, ft

8.4 Calculate the dry unit weight as follows:

$$\text{Dry Unit Weight, lb/ft}^3 = \frac{W}{V}$$

where:

W = weight of the sample, lb
V = volume of sample, ft^3

9.0 REPORT. The dry unit weight of the specimen is reported in lb/ft^3